



Standard Terminology Relating to Molecular Spectroscopy^{1,2}

This standard is issued under the fixed designation E 131; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

absorbance, A —the logarithm to the base 10 of the reciprocal of the transmittance, (T).

$$A = \log_{10}(1/T) = -\log_{10}T \quad (1)$$

DISCUSSION—In practice the observed transmittance must be substituted for T . Absorbance expresses the excess absorption over that of a specified reference or standard. It is implied that compensation has been effected for reflectance losses, solvent absorption losses, and refractive effects, if present, and that attenuation by scattering is small compared with attenuation by absorption. Apparent deviations from the absorption laws (see **absorptivity**) are due to inability to measure exactly the true transmittance or to know the exact concentration of an absorbing substance.

absorption band—a region of the absorption spectrum in which the absorbance passes through a maximum.

absorption coefficient, α —a measure of absorption of radiant energy from an incident beam as it traverses an absorbing medium according to Bouguer's law, $P/P_o = e^{-\alpha b}$.

DISCUSSION—In IRS, α is a measure of the rate of absorption of energy from the evanescent wave.

absorption parameter, a —the relative reflection loss per reflection that results from the absorption of radiant energy at a reflecting surface: $a = 1 - R$, and R = the reflected fraction of incident radiant power.

absorption spectrum—a plot, or other representation, of absorbance, or any function of absorbance, against wavelength, or any function of wavelength.

absorptivity, a —the absorbance divided by the product of the concentration of the substance and the sample pathlength, $a = A/bc$. The units of b and c shall be specified.

DISCUSSION—1—The recommended unit for b is the centimetre. The recommended unit for c is kilogram per cubic metre. Equivalent units are g/dm^3 , g/L , or mg/cm^3 .

DISCUSSION—2—The equivalent IUPAC term is “specific absorption coefficient.”

absorptivity, molar, ϵ —the product of the absorptivity, a , and

the molecular weight of the substance.

DISCUSSION—The equivalent IUPAC term is “molar absorption coefficient.”

acceptance angle, n —for an optical fiber, the maximum angle, measured from the longitudinal axis or centerline of the fiber to an incident ray, within which the ray will be accepted for transmission along the fiber by total internal reflection.

DISCUSSION—If the incidence angle exceeds the acceptance angle, optical power in the incident ray will be coupled into leaky modes or rays, or lost by scattering, diffusion, or absorption in the cladding. For a cladded step-index fiber in the air, the sine of the acceptance angle is given by the square root of the difference of the squares of the refractive indexes of the fiber core and the cladding, that is, by the relation as follows:

$$\sin A = \sqrt{n_1^2 - n_2^2} \quad (2)$$

where A is the acceptance angle and n_1 and n_2 are the refractive indexes of the core and cladding, respectively. If the refractive index is a function of distance from the center of the core, as in the case of graded index fibers, then the acceptance angle depends on the distance from the core center. The acceptance angle is maximum at the center, and zero at the core-cladding boundary. At any radius, r , the sine of the acceptance angle of a graded index fiber is defined in compliance with that of a step-index fiber as follows:

$$\sin A_r = \sqrt{n_r^2 - n_2^2} \quad (3)$$

where A_r is the acceptance angle at a point on the entrance face at a distance, r , from the center, n_r is the refractive index of the core at a radius, r , and n_2 is the refractive index of the cladding. In air, $\sin A$ and $\sin A_r$ are the numerical apertures. Unless otherwise stated, acceptance angles and numerical apertures for fiber optics are those for the center of the endface of the fiber, that is, where the refractive index, and hence the numerical aperture, is the highest.

accuracy—the closeness of agreement between an observed value and an accepted reference value (See Terminology E 456)³.

DISCUSSION—The term accuracy, when applied to a set of observed values, will be a combination of a random component and a common systematic error or bias component. Since in routine use, random components and bias components cannot be completely separated, the reported “accuracy” must be interpreted as a combination of these two components.

¹ This terminology is under the jurisdiction of ASTM Committee E-13 on Molecular Spectroscopy and is the direct responsibility of Subcommittee E13.04 on Nomenclature.

Current edition approved Sept. 10, 2002. Published June 2003. Originally approved in 1957. Last previous edition approved in 2000 as E 131 – 00a.

² For other definitions relating to nuclear magnetic resonance, see Practice E 386, *Annual Book of ASTM Standards*, Vol 03.06.

³ *Annual Book of ASTM Standards*, Vol 14.02.